

pressures again prevailed over most of the Plateau region from the 19th to the 26th, with fair weather throughout the district after the 20th. During the 27th a storm moved rapidly southward from Alberta to Utah and thence to northwestern Texas by the 29th, where it apparently dissipated, attended during its progress by light precipitation except in the extreme southern portion of the district. The last disturbance of the month appeared on the coast of California on the 29th and advanced rapidly eastward across the States of Utah and Colorado, its center being over southwestern Nebraska on the evening of the 31st. Snow or rain occurred in every part of the district, except portions of New Mexico and along the eastern slope in eastern Colorado, heavy snows falling in southern Utah, northern Arizona, southwestern Colorado, and extreme northwestern New Mexico. This storm was followed during the night of January 31–February 1 by a cold wave in extreme southern Utah and southwestern Colorado.

Warnings of a moderate cold wave were issued for southwestern Colorado, northwestern New Mexico, northeastern Arizona, and extreme southern Utah on the 3d and were fully verified. A cold-wave warning was also issued on the morning of the 18th for southern and western Colorado, New Mexico, northeastern Arizona, and southern Utah. Temperatures below zero were forecast for southern and western Colorado and southern Utah and a fall in temperature of from 20° to 30° for New Mexico by the following morning. The warning was verified except in western Colorado and western New Mexico, where the temperature remained relatively high on account of the slow movement of the low. Warnings of a cold wave in western Colorado, northern New Mexico, northeastern Arizona, and southeastern Utah were repeated at 8 p. m. of the 18th, and for southwestern Colorado, west of the mountains in northern New Mexico, and in extreme southeastern Utah at 8 a. m. of the 19th. Owing to the slow movement of the low over northwestern New Mexico, already referred to, these warnings were verified in northeastern Arizona and northeastern New Mexico only. Warnings of moderate cold waves in southwestern Utah and eastern Colorado, which were verified, were issued on the morning and evening of the 28th, respectively. Another warning of a moderate cold wave which was issued for eastern Colorado on the evening of the 31st was verified in the extreme eastern portion of the State but failed of verification near the mountains because of the effect of a portion of the low which remained over the eastern slope.

Cold waves without warnings occurred at Denver on the 18th, at Durango on the 21st, and at Modena and Flagstaff on the 29th.

Forecast of heavy snow in southern and eastern Colorado, northern New Mexico, northern Arizona, and southern Utah was made on the morning of the 30th and livestock warnings were issued for those sections. The forecast of heavy snow was repeated for the same territory on the evening of the 30th. Heavy snow fell in all of the region indicated except eastern Colorado and north-central and north-eastern New Mexico, seriously interfering with traffic. Press reports from southwestern Colorado indicate that because of the warnings that were distributed there was no loss of stock in that section at least.

Freezing temperature was forecast for south-central and southeastern Arizona on the 4th, 22d, and 23d and for all of the southern portion of that State on the 20th and 21st. Frost or freezing-temperature warnings were issued for Yuma on the 3d, 4th, 7th, 8th, 9th, 14th, 15th, 16th, from the 18th to the 28th, inclusive, and on the

31st. These forecasts were generally varified, either by the occurrence of freezing temperature or frost, or temperatures at which frost might be expected.—*J. M. Sherier.*

SAN FRANCISCO FORECAST DISTRICT.

Precipitation in the San Francisco Forecast District during January occurred in three periods. The first early in the month; the 2d—a short one—near the middle of the month, and the 3d at the close of the month. All three were due to extensions of low-pressure areas from Bering Sea that moved south near the coast. Except at the time of these rainy periods, the weather was controlled by high-pressure areas over the central Plateau States. They from time to time accumulated off-shoots from the permanent Pacific high and in one case from a large high that moved south from the Yukon country. The central Plateau high also sent out offshoots that moved eastward to the Atlantic States.

At the time and for several days after the merging of the Yukon high with the central Plateau high, the coldest weather for many years prevailed in California and Nevada. This high at about this time became so pronounced that it included the entire United States within its boundary.

The lowest barometer readings at the Bering Sea stations were 28.62 inches at Kodiak on January 3, and 28.40 inches at Dutch Harbor on January 5. Neither of these storms was followed by especially severe weather in this district.

On the 23d–24th a rather remarkable change in pressure occurred about 750 miles off the California coast. The barometer reading on the 23d was 29.70 inches, reported by one vessel and confirmed by another. The next day this low area was replaced by a high with a barometer reading of 30.30 inches. Where this disturbance went is not known, but it probably moved southeastward and later crossed Mexico, and appeared in the Gulf of that name. This disturbance was a menace to this district; but fortunately no mistake was made, as it was too far away to affect the forecast on the day it was first noted and it disappeared the next day.

Storm warnings were ordered on 10 days for one or more portions of the district and small-craft warnings were ordered on three occasions. These warnings were timely and justified in whole or in part.

Frost warnings were issued on 24 occasions and in nearly every instance were fully verified. On the 20th, 21st, and 22d killing frosts did great harm to the citrus fruit and winter garden truck in southern and central California. The frosts on the other days were not especially damaging, as the staple crops were mostly dormant and therefore not susceptible to injury by frost.

Two cold-wave warnings were issued, and both were verified.—*E. A. Beals.*

RIVERS AND FLOODS.

By H. C. FRANKENFIELD, Meteorologist.

The crest of the Ohio River flood of the last week of December, 1921, reached the Mississippi River on January 3, with a crest stage at Cairo, Ill., of 39 feet, 6 feet below flood stage. As the Cumberland and Tennessee Rivers were not high, there were no flood stages in the Ohio below the mouth of the Wabash River. From Dam No. 48 (Cypress, Ind.), to Shawneetown, Ill.; the crest stages were from 7 to 9 feet above the flood stages. The aggregate of loss and damage was small, not over \$15,000, mainly in crops, while the reported value of

property saved by the flood warnings amounted to \$200,550.

The floods in the lower White and lower Wabash Rivers were moderate, except that of the extreme lower Wabash, Mount Carmel, Ill., experiencing a crest stage of 20.5 feet, or 5.5 feet above flood stage, on January 1. Several hundred acres of wheat and clover were flooded, but it is thought that under favorable weather conditions they will survive. The value of property saved through the warnings was about \$10,000.

There were two moderate floods in the Santee River of South Carolina, one about the middle of the month, and the other from the 24th to the 30th, inclusive. Crest stages were from 1 to 1½ feet above the flood stage of 12 feet. Warnings were issued at the proper time and no damage occurred.

There was also a moderate flood without damage in the Apalachicola River of Florida from the accumulated waters of the Flint and Chattahoochee Rivers. Warnings were issued on January 14, and the crests occurred on January 15. There was no damage. Moderate to heavy rains over the drainage basin of the lower Coosa River on January 19 and 20, resulted in river stages from 4 to 7 feet above the flood stages as far down as Lincoln, Ala. Warnings were issued promptly, and losses and damage were negligible, as there was ample time to remove portable property.

The same general conditions also caused a general and more decided flood in the Black Warrior and lower Tombigbee Rivers of Alabama, and the Tombigbee did not fall below the flood stage at Demopolis, Ala., until after the close of the month. At Tuscaloosa, Ala., on the Black Warrior River, the crest stage on January 22, was 55.2 feet, 9.1 feet above flood stage, the high water continuing for four days, while at Demopolis the crest stage of 46.1 feet, 7.1 feet above flood stage, was reached on January 29, the river remaining above the flood stage for eight days. Some lowlands were inundated but there were no losses of consequence, and the high stages were of benefit to lumbermen interested in floating out timber.

The rains of January 20 and 21, were heavy and very general over the entire South, and floods set in over the headwaters of the Tennessee River, about the same time as in the rivers to the southward. The flood waters gradually extended along the Tennessee River, reaching the mouth of the river about the end of the month, although actual flood stages were not reached much below Riverton, Ala. Crest stages were a few feet above flood stages as a rule, and warnings appear to have been issued in ample time to all interested. No losses were reported except a very small amount in the vicinity of Riverton, Ala.

The Illinois River flood continued throughout the month without incident. Stages were too low to cause damage.

The only other floods reported were flash rises in the vicinity of Phoenix, Ariz., on January 2 and 3, one in Salt River, and one in Cave Creek, the latter ordinarily a dry channel. Warnings were issued by telephone, and

irrigation projects were able to protect dams and guard canals. No damage was reported along Salt River, but the Cave Creek flood caused an 80-foot break in the south bank of the Arizona Irrigation Canal and the overflow waters overspread a large area of farm land and a portion of the northwestern section of the city of Phoenix. As crops were all gathered, the flood caused inconvenience rather than loss, and the damage to irrigation canals approximated only \$1,500.

Flood stages during January, 1922.

River and station.	Flood stage.	Above flood stages—dates.		Crest.	
		From—	To—	Stage.	Date.
ATLANTIC DRAINAGE.					
<i>Santee:</i>	<i>Feet.</i>			<i>Feet.</i>	
Rimini, S. C.	12	12	16	13.2	15
	12	26	29	13.4	27
Ferguson, S. C.	12	14	20	12.7	17
	12	24	30	12.6	25, 28
<i>Apalachicola:</i>					
River Junction, Fla.	12	13	14	12.4	14
Blountstown, Fla.	15	14	14	15.1	24
<i>Coosa:</i>					
Gadsden, Ala.	22	22	29	24.8	23
Lock No. 4 (Lincoln, Ala.) ..	17	22	30	20.5	22-23
<i>Etowah:</i>					
Canton, Ga.	11	22	23	15.2	22
<i>Oostanaula:</i>					
Resaca, Ga.	25	21	25	32.0	22
<i>Tombigbee:</i>					
Demopolis, Ala.	39	25	(**)	46.1	29
<i>Black Warrior:</i>					
Tuscaloosa, Ala.	46	22	24	55.2	22
MISSISSIPPI DRAINAGE.					
<i>Ohio:</i>					
Cloverport, Ky.	40	(*)	2	43.4	1
Dam No. 48, Ind.	35	(*)	5	42.0	1
Henderson, Ky.	33	(*)	5	40.9	1
Evansville, Ind.	35	(*)	5	42.6	1
Mount Vernon, Ind.	35	(*)	6	42.6	1
Shawneetown, Ill.	35	(*)	7	44.3	2
<i>Green:</i>					
Lock No. 2 (Rumsey, Ky.) ..	34	(*)	1	34.1	1
<i>Wabash:</i>					
Mount Carmel, Ill.	15	(*)	5	20.5	1
<i>White:</i>					
Decker, Ind.	18	(*)	4	22.9	1
<i>East Fork of White:</i>					
Shoals, Ind.	20	(*)	1	23.7	1
<i>Tennessee:</i>					
Knoxville, Tenn.	12	21	23	19.0	22
Chattanooga, Tenn.	33	23	25	35.8	24
Bridgeport, Ala.	24	24	25	24.2	25
Guntersville, Ala.	31	24	27	33.1	26
Florence, Ala.	18	24	29	19.1	28
Riverton, Ala.	32	23	30	37.9	28
<i>North Fork of Holston:</i>					
Mendota, Va.	8	20	20	9.7	20
	8	22	22	9.0	22
<i>French Broad:</i>					
Dandridge, Tenn.	12	22	22	12.6	22
<i>Big Pigeon:</i>					
Newport, Tenn.	6	20	22	10.2	21
<i>Little Tennessee:</i>					
McGhee, Tenn.	20	22	22	23.7	22
<i>Hiwassee:</i>					
Charleston, Tenn.	22	21	23	26.7	22
<i>Illinois:</i>					
Peru, Ill.	14	(*)	20	17.2	7
Henry, Ill.	7	(*)	23	9.2	9-10
Peoria, Ill.	16	7	13	16.3	12
Beardstown, Ill.	12	(*)	20	14.0	7-10
COLORADO DRAINAGE.					
<i>Salt:</i>					
Phoenix, Ariz.	5	3	3	7.2	3

* Continued from December, 1921.

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